epiTRENDS
A Monthly Bulletin on Epidemiology and Public Health Practice in Washington State

Tick-borne Diseases: Symptoms, Diagnosis, and Prevention

Vol. 10 No. 4
4:05

A 10-year old boy went hunting with his father in rural central Washington. They stayed in a rustic hunting cabin that is closed up for much of the year. One week after the trip, the boy developed a headache, myalgia, nausea, and a fever. The fever lasted for three days before resolving, but reoccurred after another seven days. He was taken to his health care provider, who made a diagnosis after viewing spirochetes in a dark-field preparation of fresh blood. What was the boy's diagnosis?

Answer: Tick-borne relapsing fever (TBRF). Caused by *Borrelia hermsii,* TBRF is characterized clinically by recurring fevers with a median duration of three days (range: 2–7 days) and alternating afebrile periods with a median duration of seven days (range: 4–14 days). Fevers might be accompanied by headache, rigors, diaphoresis, arthralgia, myalgia, dizziness, nausea, or vomiting. Without treatment, up to 10 relapsing episodes might occur. TBRF contracted during pregnancy can cause spontaneous abortion, premature birth, and neonatal death.

TBRF is the most common endemically acquired tick-borne disease in Washington. Persons with the disease often do not report a tick bite, but state they slept in a rustic cabin within the previous 5–15 days.

Ticks in Washington

In Washington State people and animals may encounter both hard and soft ticks. While most tick bites do not cause any disease in humans, ticks can be vectors of a variety of diseases. Identifying the type of tick can narrow down the diseases it can transmit.

Hard ticks found in Washington include primarily *Ixodes* and *Dermacentor* species. People walking or hiking in brushy, wooded areas, meadows, and tall grasses or weeds may encounter these ticks. If not removed promptly, hard ticks can stay attached to their host for several days. A significant period of attachment (24–36 hours) is usually needed for them to transmit diseases such as Lyme disease or Rocky Mountain spotted fever. Diseases transmitted by hard ticks tend to be seasonal, with most cases occurring in the spring and summer due to the increased activity of the ticks during these seasons.

Soft ticks (*Ornithodoros* spp.) typically live in rodent nests at altitudes above 1,500 feet and feed on chipmunks and other small rodents. Soft ticks transmit *Borrelia hermsii*, the bacteria that causes tick-borne relapsing fever (TBRF). Overnight stays in caves and rural mountain cabins accessible by rodents can expose people to these ticks. *Ornithodoros* ticks feed at night for under an hour; their bites are painless and typically unnoticed.

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Tick-borne Diseases in Washington

None of the tick-borne diseases are commonly acquired in Washington. Residents who travel are often exposed in other states and countries. Table 1 lists the major tick-borne diseases and their primary geographic distribution in the United States. Less common tick-borne diseases that occur in the United States include Powassan virus encephalitis, Southern tick-associated rash illness, and other erhlichiosis syndromes.

Of the eight conditions listed in Table 1, six are indigenous in Washington. They are Lyme disease, relapsing fever, tularemia, babesiosis, Rocky Mountain spotted fever, and tick paralysis. Tick paralysis is not a notifiable condition, so the frequency of occurrence in Washington is unknown. Rocky Mountain spotted fever and babesiosis rarely occur here. In the past 10 years, three cases of babesiosis and six cases of RMSF were reported.

TABLE 1: Major tick-borne diseases in the United States

Disease	Causative Agent	Vector	U.S. Region
Lyme disease	*Borrelia burgdorferi*	*Ixodes* ticks	Northeast Midwest Mid-Atlantic West Coast
Tick-borne relapsing fever	*Borrelia hermsii*	*Ornithodoros* ticks	West
Babesiosis	*Babesia* spp.	*Ixodes* ticks	Northeast West Missouri
Tularemia	*Francisella tularensis* (2 biovars)	*Dermacentor* and *Amblyomma* ticks, deer flies, and non-vectored modes of transmission	Widespread
Rocky Mountain spotted fever	*Rickettsia rickettsii*	*Dermacentor* ticks	Southeast, West South Central
Ehrlichiosis (monocytic)	*Ehrlichia caffeensis*	*Amblyomma* ticks	South Central
Anaplasmosis	*Anaplasma phagocytophilum*	*Ixodes* ticks	See Lyme disease
Colorado tick fever	Coltivirus spp.	*Dermacentor* ticks	West
Tick paralysis	Toxin	*Dermacentor* and *Amblyomma* ticks	West South

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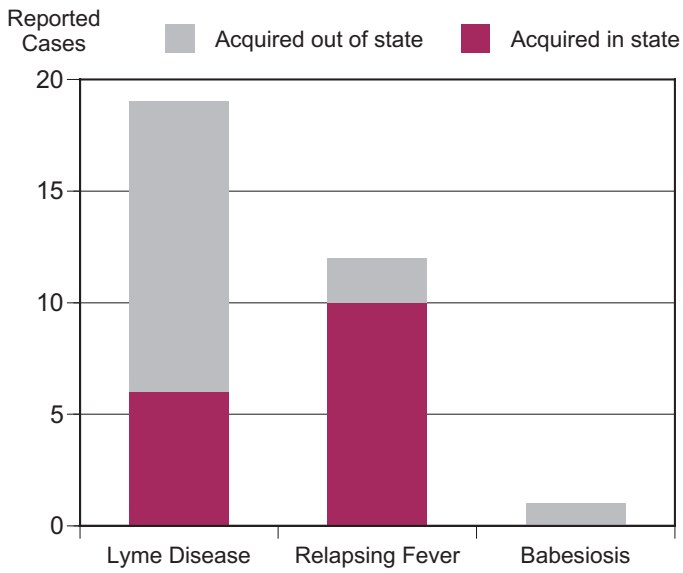
Relapsing fever is the most common tick-borne disease acquired in Washington, although travel-associated Lyme disease is reported more often as shown in Figure 1. Of 19 cases of Lyme disease reported in 2003–2004, only six were potentially acquired in the state.

FIGURE 1: Common tick-borne diseases reported in Washington, 2003–2004



Lyme Disease

Lyme disease, it is the most commonly reported tick-borne infectious disease in the United States, but numerous problems are associated with laboratory diagnosis. *MMWR* issued a notice on February 11, 2005 titled "Caution Regarding Testing for Lyme Disease." (http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5405a6.htm)

Information disseminated about Lyme disease may be unreliable, and the Centers for Disease Control and Prevention (CDC) has developed a new website to guide readers to accurate vs. inaccurate information on the Internet (http://www.cdc.gov/ncidod/dvbid/lyme/bibliography.htm).

Transmission of Lyme disease requires prolonged tick attachment (36–48 hours). Lyme disease most often presents with a characteristic "bull's-eye" rash (erythema migrans), accompanied by nonspecific symptoms such as fever, malaise, fatigue, headache, muscle aches (myalgia), and joint aches (arthralgia). The signs of disseminated infection occur days to weeks after the erythema migrans lesion, and may manifest as heart block, neurological disease (lymphocytic meningitis, cranial neuropathy, especially facial nerve palsy, and radiculoneuritis), migratory joint pain, or myocarditis.

Other Tick-borne Illnesses

Although TBRF is the most common endemically acquired tick-borne disease in Washington, other tick-borne diseases are occasionally reported. Two unrelated cases of babesiosis in Washington (1994 and 2002) were caused by previously unknown species of the organism. Tularemia can be tick-borne, although it is more commonly associated with exposure to mammals. Of the 15 cases of tularemia reported in Washington in the past five years, only one was potentially associated with a tick.

Diagnostic and Treatment Cautions

Tick-borne relapsing fever is usually diagnosed by visualization of spirochetes on a peripheral blood smear. Other tick-borne diseases are less common in Washington, and diagnosis can be difficult. Commercial serological testing should be interpreted with caution. If you are uncertain about the proper test for a disease, contact your local health jurisdiction for guidance. Public health agencies can facilitate reference laboratory testing for patients with febrile illness and compatible exposure histories.

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Because diagnosis is difficult, antibiotic treatment may be considered based on appropriate clinical presentation and exposure history. However, patients without symptoms of infection *should not* receive routine prophylactic antibiotic therapy following a tick bite. Vaccines are not available for any tick-borne disease. People should take precautions when entering tick-infested areas, particularly in the spring and summer months.

Preventing Tick-borne Disease Caused by Hard Ticks

- Wear light-colored clothing that covers arms and legs. Tuck in clothing, including pants into socks.
- When working or hiking outdoors, rest on a rock, tarp, or area without plants.
- Consider using insect repellent that is approved for use against ticks. Repellents containing permethrin can be sprayed on clothing, and will last for several days.
- When spending time outdoors, routinely check yourself or have someone else help check for ticks on your body and clothing.

Tick Removal: Use blunt tweezers or forceps or wear protective gloves and use your fingers to remove embedded ticks. Grasp the tick as close to the skin as possible and remove the tick by slowly pulling upward to avoid leaving broken mouthparts beneath the skin. Do not crush or puncture the tick since it may carry disease. Wash the bite with soap and water and apply an antiseptic.

Tick-borne relapsing fever prevention measures: Because soft ticks are likely to bite at night and are only attached for a short time, preventative measures differ from those for hard ticks. The best protection against relapsing fever is avoiding soft-tick exposure. Watch out for potential risks when visiting or camping in mountainous or wooded areas.

If you stay in a cabin:

- Check the sleeping areas for evidence of rodents: for example, holes in the floor or walls, shredded material from mattresses, and rodent feces on counters or in cupboards.
- Avoid sleeping on the floor or on a bed that touches the wall.
- If the dwelling has been unoccupied, change and wash all bedding before use.

Rodents spread many diseases, so household rodent control is an important health measure.

Follow these steps:

- Thoroughly check the outside walls and foundation of the building for any openings through which rodents might enter.
- Ensure that external doors and windows close with a tight seal.
- Keep all food and garbage in tightly sealed containers.
- Promptly clean up any leftover or spilled food and pet food.
- Avoid feeding squirrels, chipmunks, and other rodents around dwellings.
- Eliminate wood piles in, near, or under the house. Store firewood outside, away from walls. Stack wood on pallets or otherwise raised a few inches off the ground to discourage rodents from using these areas as nesting sites.

Tick control:

- Even if a building is rodent free, direct control of ticks in an infested building is necessary for comprehensive prevention of relapsing fever. Hungry ticks still seek out other mammals upon which to feed if rodents are unavailable. Contact a licensed professional exterminator to discuss best tick control measures for your dwelling.

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